

## **Indoor Air Quality**

### **Student Worksheets**

This document includes worksheets for the entire lesson. Parts of the lesson that use the worksheet are bolded below.

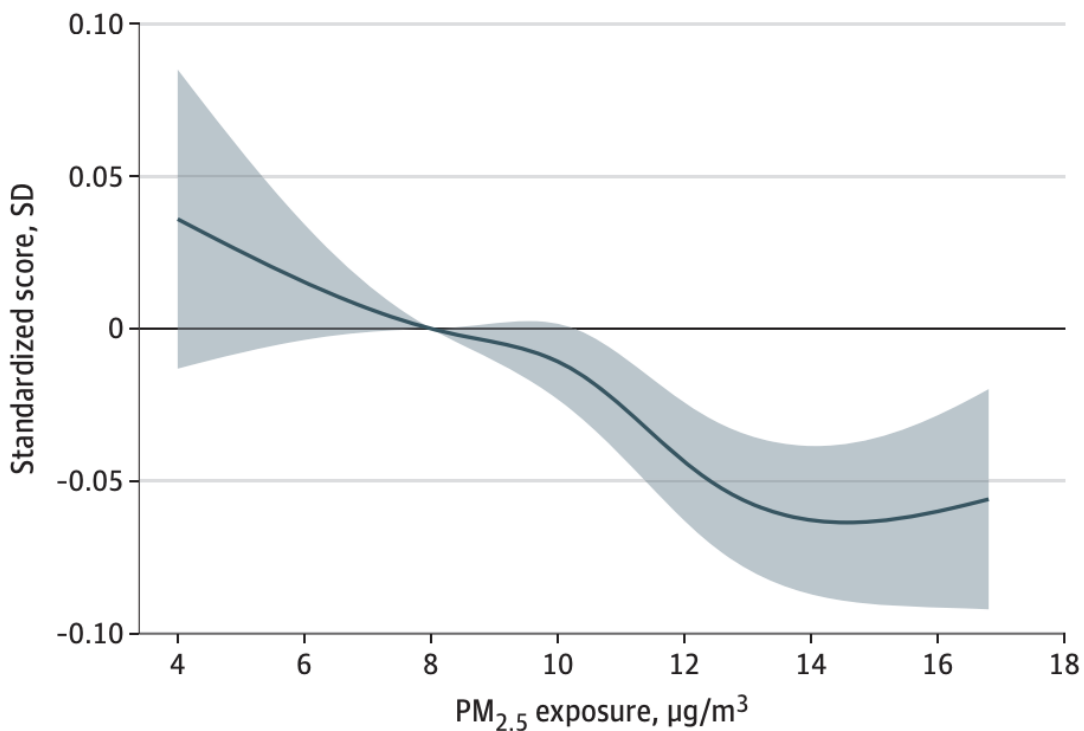
1. Elicit students' ideas about indoor air quality through think-pair-share and introduce the term "particulate matter."
- 2. Define the problem using multiple sources.**
- 3. Identify criteria and constraints of a solution.**
4. Prepare students to build the air purifier.
5. Build the air purifier.
- 6. Students test the air purifier to see if it meets the criteria and constraints.**
- 7. Have students investigate air movement with the tissue test.**
- 8. Students plan an investigation relating to IAQ.**
- 9. Collect, analyze, and interpret data**
- 10. Introduce science communication.**

## Indoor Air Quality: What is it and why does it matter?

In a study published in 2023, Dr. Lam and colleagues analyzed test scores from 3rd through 8th grade students in North Carolina from 2000 to 2018 and compared them to the particulate matter concentrations of the schools. In order to focus on particulate matter (and not other variables), the scientists standardized the test scores. This graph shows the percent change of test scores.

Source: Lam, P. H., Zang, E., Chen, D., Liu, R., & Chen, K. (2023). Long-term exposure to fine particulate matter and academic performance among children in North Carolina. *JAMA Network Open*, 6(10), e2340928.

**C** Mathematics test scores



Based on this graph, how does exposure to particulate matter affect math test scores?

Record your observations and questions from the resources below.

| <b>Source</b> | <b>Observations (I notice...)</b> | <b>Questions (I wonder...)</b> |
|---------------|-----------------------------------|--------------------------------|
| Graph         |                                   |                                |
| EPA chart     |                                   |                                |
| Video         |                                   |                                |
| Infographic   |                                   |                                |

## **Engineering Design**

Define the problem with evidence from multiple sources.

To engineer a solution for our classroom, we need to know the criteria (requirements) and constraints (restrictions or limitations).

Suggest at least three criteria and three constraints for a solution to the problem.

Criteria:

Constraints:

## Testing and Optimizing the Design

What do we need to do to determine whether the air purifier meets our criteria? Write a few ideas below.

Data Table

| Time → | 0 mins | 10 mins | 20 mins | 30 mins | 40 mins |
|--------|--------|---------|---------|---------|---------|
| AQI    |        |         |         |         |         |
| PM     |        |         |         |         |         |

Sketch a model of air movement with the air purifier turned on and off.

How might we be able to optimize, or improve, this design? Consider the criteria and constraints as well as other ideas you have.

## **Planning an Investigation**

1. What variables can we manipulate? List as many as you can!
2. What variables can we measure? List as many as you can!
3. Choose your independent and dependent variables. Write a testable question.

4. Draft a procedure for your investigation. Be sure to describe what data you will collect.

5. What are some challenges to this experiment?

#### Exit Ticket

1. What is the purpose of the air purifier?

2. What is the purpose of the shroud?

## **Analyzing Air Quality Data**

Write a claim supported by your data.

Use evidence from your data to support your claim.

Explain the claim and evidence. Why does this claim make sense?

Exit Ticket

1. Who would want to know about these results?
2. How might we present the results to that audience?

## Communicating the Results

RAFT stands for Role-Audience-Format-Topic. Your role is a student, and your topic is indoor air quality. Choose your audience and format to communicate the results of your investigation.

| Audience     | Format                           |
|--------------|----------------------------------|
| PTO          | Social media post(s) or campaign |
| School Board | Letter                           |
| Politicians  | Presentation (slides)            |
| Others?      | Infographic                      |
|              | Report                           |